

Abstract

Rare Earth Elements in Coals and Coal-Byproducts: Prospecting for Domestic Unconventional Strategic Mineral Resources

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Rare earth elements (REEs) are important strategic minerals with unique magnetic, phosphorescent, and catalytic properties that are extensively utilized in US industries to manufacture high-tech products, including consumer and defense electronics, high-strength magnets, car batteries, solar cells, wind turbines, energy-saving lighting, electric vehicles, etc. Although the US has limited REE occurrences in California (Mountain Pass) and Wyoming (Bear Lodge), it requires sustainable domestic supply to power its ever-growing high-tech industry. At present, the US is dependent on foreign supplies, especially from China, which controls >90% of the global REEs market.

Recently, DOE/NETL (National Energy Technology Laboratory) spearheaded a national effort to explore for unconventional REE resources in U.S. coals and coal-ash products. In 2014, the US coal and coal-ash productions were at >1 billion short tons and >100 million tons, respectively. Based on average concentrations of about 470 ppm REEs and yttrium (REEs+Y), it is estimated that the coal-ash products contained about 47,000 tons of these critical minerals, which is four times of what was the US annual consumption in 2011. Reconnaissance studies of New Mexico coals revealed higher concentrations (500-1500 ppm) of REEs and other high-value metals. More effort is being made to identify coal deposits with higher contents of these critical minerals. Recently, a LANL team submitted a proposal to NETL to develop a field-based analytical tool for determining the chemical and mineralogical contents of REEs+Y in coals and associated sediments and use the data to develop effective extraction methods.

Ultimately, extraction of REEs and Y and other high-value metals from coals and associated sediments and coal ashes are likely to increase the value of coal thereby generating more financial gains for the coal industry to design environmentally efficient power plants while producing domestic strategic mineral resources for the US high-tech industry.

Project seminar

The presentation will highlight background information on REEs+Y, preliminary studies at LANL, and ongoing national efforts to develop efficient extraction methods.

Biosketch

Giday WoldeGabriel is a geologist in the Earth and Environmental Science Division. He conducts field- and laboratory-based geological characterizations related to different types of environmental clean up and restoration, paleoenvironmental and paleoclimate studies, and natural hazard assessments etc. Giday came to LANL as a Director's postdoctoral fellow and is a LANL Fellow and a Fellows Prize winner.